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ABSTRACT

Current patterns of energy management within higher education institutions and energy-related information and services that are needed by senior administrators and others to develop and improve energy management and planning on campus were studied. The findings and recommendations will be used to help develop a new research and action program for the American Council on Education's Energy Task Force. Extensive interviews were conducted with top administrators, faculty, and student representatives at 10 college and university campuses. Interviews also were conducted with government and industry personnel to learn about their perceptions of higher education's energy condition, and to determine what assistance is, or could be, available to higher education. While the clear responsibility for energy management was within physical plant operations at each campus, the styles ranged from specific staff assigned to energy conservation to simple pursuit of ad hoc efforts within the whole maintenance program. Colleges identified local utility companies and vendors as the knowledge resources they rely on most often, followed by the expertise of other administrators and professionals. Additional topics that were surveyed include: energy usage and costs, contingency planning, public relations efforts, efficient heat and electric production, additional sources of fuel, financing energy conservation, and financing capital improvements. Energy usage in higher education and industry are compared, and national policy is considered. An annotated bibliography, case studies bibliography, listing of indexes and periodicals, and a literature and services review are appended. (SW)

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ENERGY MANAGEMENT NEEDS: A PROJECT TO DEVELOP SOLUTIONS FOR HIGHER EDUCATION'S ENERGY PROBLEMS IN THE 1980'S

A Report on the Study Conducted
by the American Council on Education
for Higher Education's Energy Task Force

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I. INTRODUCTION

Background for the Project

The Energy Task Force (ETF) was formed in 1974 to create programs to stimulate, improve and ensure the efficient use of energy by colleges and universities and to keep their administrators aware of emerging national energy policy.

The EFT program has three basic components: energy information sharing, institutional energy management, and advising on federal energy law and regulation. These have resulted in publications and workshops for college business officers and physical plant administrators. Issues addressed have encompassed technical improvements for energy cost savings, energy usage audits, and effective energy management systems, including central computer control systems and other innovations.

In assessing their past accomplishments and looking toward the future, the ETF has identified the need to emphasize overall campus energy management. Presidents, trustees, the faculty and students should have a heightened awareness and commitment to energy conservation. To further this goal, college presidents have been added to the ETF membership and the Task Force has begun an explicit process to define new objectives and strategies to encourage energy management and planning.

To broaden the members' perspectives and add depth to these deliberations, the ETF commissioned the following study. The study, based on visits to ten campuses, reports

on current patterns of energy management, needs for the future, and possible solutions which the ETF could implement.

Purpose of the Project

To assist in shaping its future agenda and find ways to effectively communicate with and provide information useful to presidents, business officers, physical plant administrators, faculty, students and the rest of the higher education community, the ETF requested ACE to conduct a study to determine the following:

1) Describe and analyze the current "state of the art" in energy management within higher education institutions.
2) Identify the energy-related information and services needed, especially by senior administrative levels, to develop and improve campus-wide energy management and planning.

The report will be used to help develop a new research and action program for the ETF. It is intended to be a readable, conceptual backdrop for a new research and program agenda for the ETF.

The perspective of most previous energy-related advice and analysis for colleges has been from that of technical physical plant operators. This perspective is crucial, but with the growing need for capital investment for energy cost savings and the increasing pressure of energy cost increases and supply

uncertainties, a general and financial management perspective on the issue is increasingly necessary. This project is intended to fill that gap.

Extensive interviews were conducted with top administrators, faculty and student representatives at ten college and university campuses. (See Appendix for method of selection.) The campuses visited were selected for their representation of different educational and energy infrastructures and management styles.

List of Officials Interviewed*

President
Chief Financial Officer
Physical Plant Director
Energy Conservation Program Director
(or Interest Group Leader)
Representative of Faculty Sentiment
Board Members
Dean of Student Life and/or Student Leader

Interviews were also conducted with government and industry personnel to learn about their perceptions of higher education's energy condition, and determine what assistance is, or could be, available to higher education.

*Especially at larger universities, there were other members of the President's cabinet such as the Provost, Chief Academic Officer. Vice President for Administrative Affairs, etc., included.
Where a campus is part of a larger system, the system officials were interviewed, too.

Colleges and Universities Visited

About ten hours of interviews were conducted at each of these campuses during Spring 1981 to provide material for this study. We wish to thank the presidents for consenting to have their institutions participate and especially the staff who acted as hosts and liaison in scheduling the interviews.

Institution	Chief Executive	Liaison
CHATHAM COLLEGE Pittsburgh, Pennsylvania	Alberta B. Arthurs President	William L. Dillon Treasurer & Business Manager
FAIRFIELD UNIVERSITY Fairfield, Connecticut	Aloysius P. Kelley, S.J. President	John M. Hickson Vice President for Business & Finance
FRANKLIN PIERCE COLLEGE Rindge, New Hampshire	Walter R. Peterson President	Robert N. Wiley Dean of Business Affairs
JOHNS HOPKINS UNIVERISTY Baltimore, Maryland	Steven Muller President	Robert J. Schuerholz Executive Director, Administrati Services
LINCOLN LAND COMMUNITY COLLEGE Springfield, Illinois	Robert L. Poorman President	Robert L. Poorman President
PIMA COMMUNITY COLLEGE Tuscon, Arizona	S. James Manilla President	Donald F. Klaasen Vice President for Administrativ Services
POMONA COLLEGE Claremont, California	David Alexander President	Frederick Moon Vice President & Treasurer
STATE UNIVERSITY OF NEW YORK AT STONY BROOK Stony Brook, New York	John H. Marburger, III President	Sanford M. Gerstel Assistant Executive Vice President
UNIVERSITY OF NORTH DAKOTA-MAIN CAMPUS Grand Forks, North Dakota	Thomas J. Clifford President	Leroy Sondrol Director of Plant Services
UNIVERSITY OF TEXAS AT SAN ANTONIO San Antonio, Texas	James W. Wagener President	George Mangrem Director of Physical Plant

II. The State of the Art in Energy Management

The basic need for energy management appears to be an accepted operational goal at all of the colleges visited. The philosophies underlying the efforts and the perceived constraints differ considerably. While the clear responsibility for energy management was within physical plant operations at each campus, the styles ranged from specific staff assigned to energy conservation to simple pursuit of ad hoc efforts within the whole maintenance program.

- Energy Usage Down

Every college visited could report considerably reduced energy consumption over the amount used several years ago -- often despite new buildings and increased square footage. (See accompanying table.) Every campus had accomplished numerous "quick fix" conservation measures, such as adjusting temperature ranges, shutting down heating, lights and equipment when not in use, improving maintenance procedures. They have also undertaken various capital improvements.

- Energy Costs Up

Despite reduced consumption, price increases have raised the energy bills most colleges pay. (See accompanying chart.)

- Not Always an Energy Management Plan

Those college personnel who are aware of the individual concepts contained in published energy managment recommendations are not likely to have adopted "a program" as described in the literature. About one half of the colleges had conducted standard "energy audits," some were currently in the process of doing this. Nevertheless, all the colleges had pinpointed their energy hogs and obvious ways of reducing consumption and had worked on these over the last several years. Now that the ways to save are becoming more technical, and less obvious, they are looking to more extensive energy audits and capital improvements as ways to save more.

- Philosophies Underlying Reduced Consumption

The philosophies underlying conservation effort began primarily with keeping institutional utility costs down. Several of the institutions, principally public ones, also felt that they had an obligation to participate in the national effort to conserve energy. These views could be seen in the physical plant adminstrators who saw it as a professional obligation and challenge to reduce energy waste. The presidents of the institutions, especially the larger ones, also acknowledged the leadership and participatory responsibilities of the institution to conserve energy. At almost every

institution, a few faculty were independently involved in presenting workshops or courses on energy conservation for community residents, and sometimes, for undergraduate students.

In terms of the effective constraints perceived by the administrators, three clear patterns arise:

- Residential colleges, particularly those that regard the pleasant campus as a major asset in attracting students, have student comfort as a priority. (If a student writes home repeatedly and tells her mother she's cold, a student may be lost.) Thus efforts to reduce dormitory heating temperatures must be coupled with extensive efforts to be sensitive to individual comfort levels.
- Community colleges and other commuter campuses can make the choice to close down the campus completely on weekends and holidays. Some have gone to four-day summer sessions for energy conservation and closed operations completely for three days each week. They have also considered the possiblity of a year-round four-day week, if necessary. The big concern in community and commuter colleges is the availability and cost of gasoline or other transportation for students to come to college. Thus far they have not noticed an adverse impact on enrollment due to gas prices, but a gas crunch could be very damaging. The importance of branch campuses, television delivery technologies, and modular courses increase with this uncertainty.

- Research universities, in addition to the real difficulties of conserving energy in heating and cooling plants of buildings which must be environmentally controlled 24 hours a day, 7 days a week all year -- or face the loss of research experiments and equipment -- have an additional constraint. The mystique surrounding the autonomy and indeperdence of faculty members in this setting appears to forbid troubling them with a discussion of these mundane matters. This perception is notably absent at the nonresearch colleges, where administrators do presume they can tell faculty what to do in operational areas. This constraint probably could be regarded as an amusing fact-of-life, except that research and science buildings and equipment are routinely among the largest campus energy users -- not simply because they are research-oriented, but because they tend to be buildings designed in the late 1960s, they are large and use massive, energy inefficient heating and cooling systems.

Space Utilization

There is a basic dichotomy of philosophy and strategy on effective space utilization. First, it is very expensive to build college facilities. The institution has the goal of using its space as much as possible and ideally making it available for use 24 hours a day, 7 days a week. This maximizes return on the capital investment. Then there is the other situation: The institution determines to close down buildings on weekends and evenings, hold 4-day summer sessions, long vacations, etc., to save operating costs.

Thus, the dichotomy: Is our goal to make our facilities available anytime, all the time, for academic and community purposes? Or are we going to reschedule all possible activities to fit the constraints of least-cost energy and facilities management? Should we lower our operating costs, but essentially raise the unit cost of using a facility?

Every institution has to find its place on this continuum itself. This is an important internal policy question, both in the aggregate and on a building-by-building basis. Both academic and fiscal/operating staff should consider the trade-offs. If users are not billed directly for use of the building, then does rising unit cost have any potent significance? What constitutes an effectively used building? 1/

1/ There is actually a third dimension of this issue: individual classroom and facility capacity. If a classroom meant to hold 40 students is occupied by only 6, this could be regarded as inefficient underutilization. Likewise to light and heat a gymnasium so that two people can play one-on-one basketball is an expensive underutilization. Institutions may wish to judge the intensity of use in determining their facilities policies.

With a central energy plant, cost savings are harder to find by closing off portions of the campus. But modularizing the plant is a possibility--if there are times of the year when the overall usage is low. (In some cases, staff and faculty are asked to consolidate into fewer buildings during vacations.)

The tensions between maximizing use or operating efficiency is at the root of many institutional discussions on energy conservation. Very different situations in terms of space utilization are found on different campuses. A number of campuses visited are very close to full capacity in dormitory and classroom space. They are acutely aware of space, because they use it so intensively. If they are close to practical capacity, chances are that they do not have much flexibility in changing uses, consolidating uses, or closing down space. In the case of Pima Community College, over one-third of their courses are held in 43 rented "education centers" spread across southern Arizona. These facilities are usually local high schools, thus contributing to using those public buildings more hours of the day. Many private residential colleges seek year-round use of their facilities both to increase income and reduce the unit cost of facility use. Also, during the summer months in unairconditioned buildings, energy costs are dramatically lower, making use even more sensible.

Campus Energy Committees

Although a number of campuses had established energy committees of campus constituents at one time or another, none were maintained on a permanent basis. Several were responsible for studies; none appeared to be organized around a direct purpose of building campus awareness, although they may have made recommendations in that area as part of their study. Another finding is that none of the committees was visible enough that all of the other interviewers knew about it.

When asked if they had committees, most administrators said they currently didn't, or never had, but that they thought a committee would be a good idea in building awareness.

Although committees are an oft recommended tactic in academic problem-solving, I found no evidence that these energy committees had performed any significantly useful function, especially over the long term.

Recommendation: The ETF should discuss and consider abandoning the tactic of committee formation to promote energy awareness. There may be some benefits which are not considered here, such as stimulating the physical plant administrator to consider new ideas, but there are probably better ways to do that.

Rather than forming a committee specifically for energy, it might be worthwhile to consider giving this task of energy awareness to an already established committee. Often some kind of buildings and grounds committee exists.

Sources of Information and Expertise Utilized

Colleges identify local utility companies and vendors as the knowledge resources they rely on most often. Next comes the expertise of other area physical plant administrators, the campus engineering and other faculty and physical plant professionals meetings (primarily at the state level and below).

Most presidents, business officers and physical plant administrators acknowledge the existence of a great deal of literature on energy conservation--much in the form of vendor brochures and newsletters. They generally do not have the time to read it, however. They also approach the need for knowledge on a problem--or discrete issue--basis. "My college needs to reduce electricity consumption. Where can I find out the alternatives we have?" Thus, almost no one, particularly the nonphysical plant administrators perceive the time available for reading up on energy conservation, they will only pursue it on an "as critically needed" basis. Many suggested a clearinghouse of information. None knew about the "ETF hotline." Most also wanted campus-tested ideas and knowledge about what different campuses were doing. They would also like to be able to judge their efforts against those of other colleges. Most were aware of the NACUBO cost-reduction awards and paid attention to those examples.

Recommendations: Except in particular technical areas and for small audiences, efforts to produce publications probably would be better diverted into expanding the "Energy-Idea-of-the Month" concept to get similar short articles and "boxes" in the other higher education association newsletters.

These boxes should incorporate one idea of wide use with some specifications, naming colleges and individuals if possible, on at least a couple of "facts."

This could be accomplished by providing a copy to the newsletter editors in a standardized format on a regular basis. Creation and use of such copy is a regular part of the newspaper business and is practiced by many trade associations. For instance, the Chamber of Commerce has a regular service to provide such copy to other associations and the general press. Syndicated columns are also handled this way.

The two keys to sucess are:[1/]

1) Standard format--set an arbitrary length so that editors can plan to save the necessary space when they are laying out the paper, even before they receive this issue's copy. It does not need to be camera-ready; most would prefer to type-set it to their style, but might include a master-head or logo for paste-up.

2) Regular reliable delivery of copy: If the editor cannot depend on delivery of the copy, the feature will be dropped. Therefore, several month's worth of "energy tips " should be prepared and held on file, so there is no difficulty providing timely copy.

[1/] Bob Aaron, ACE's Director of Public Affairs, provided these ideas and would be quite willing to provide advice and assistance if ETF decides to undertake the service.

Contingency Planning

Despite the ETF's concern about the importance of contingency planning, no administrators at the site visit institutions found this to be critical, except to the extent they kept pipes from freezing. Those in severe climate areas, North Dakota and New Hampshire, had strategies to prevent pipes freezing (although Franklin Pierce has not been able to implement its plan yet).

The general comment when asked whether they had planned for a national fuel emergency was "No, we will be as bad off as everyone else. Why should we be different? We'd just have to close down like others."

For local emergencies, colleges are more likely to be prepared. North Dakota keeps a 30-day coal stockpile to protect chiefly against problems in delivery of the coal by railroad. Johns Hopkins is on "interruptable customer" natural gas service and has its own 90,000 gallon tank of oil as a back-up source. During an electric power emergency in Pittsburg, Chatham College moved classes to dormitories and all possible activities to naturally lighted areas.

Alternate Fuels: Most colleges were aware of the need for some alternate fuel capacity and had a small capability. New boiler purchases are dual fuel. Franklin Pierce would like to find a way to make burning wood feasible.

Recommendation: The ETF should reconsider its interest in investing resources for contingency planning. As a discrete issue, this is

not an administrative concern; other issues take priority. However, in certain areas, such as planning boiler purchases, planning for flexibility in future fuels is important. Emphasis should be placed specifically on this point.

Colleges are prepared to deal with localized emergencies, by consolidating uses, and switching to alternate fuel sources.

Public Relations Efforts

There is a need for public relations about energy on campus, but it is not clear that some of the suggestions which are traditionally in energy management literature are actually going to help. The paperflow of newsletters and memorandum is incredible. To be effective there has to be a real effort by the college president to indicate that energy is a priority. It is very difficult for the directors of physical plant to feel that it is worth the effort unless they have presidential backing.

Tradition within many colleges assumes that faculty should not be bothered with mundane operational problems, such as energy conservation practices. Managerial and physical plant personnel see their responsibility as providing the faculty and research staff with all needed facilities and services in an "invisible" fashion. Therefore only central plant or "invisible" conservation efforts can be practiced without reaching the very low level of tolerance for disruption.

In one state university the facilities and operations manager will not allow the physical plant personnel even to discuss possible energy saving methods with the Dean of the Medical School and other research leaders.

The Energy Task Force Visibility

The "Energy Task Force" does not have name identification at the colleges. Physical plant administrators are aware of APPA, and have the ETF publications on their bookshelves, but identify them with APPA. Other administrators are generally unaware of the ETF, although they do acknowledge that there is much literature on energy conservation even if they do not read it themselves, route it elsewhere, or throw it away.

Physical plant administrators did not single out any ETF publications as especially valuable. They did find APPA meetings and state and local APPA-related associations to be very useful. Almost all cited their regional (state, or state public system, or metropolitan area) physical plant administrators' meetings as a valuable resource.

- Recommendation: prepare some audio-visual tools or other meeting programs for use in this local meeting setting.
- Recommendation: determine whether name recognition is important to the ETF program. It may not be; on the other hand, people do not recognize it as a readily available resource.
- Recommendation: Consider some completely new strategies for delivery of ETF services.
    - available consultants to visit campuses on request.
    - product endorsements
    - creating linkages with consortia, state college associations and other institutional groups that deal with multiple levels of administrators and are regionally based (same climate, type of construction, etc.).

Need for Data to Track Success

The physical plant staff needs to record data on each of the different energy systems: fuel consumption, system efficiency, temperature and amount of return condensate, building temperatures. Some data should be kept on a weekly or daily basis to ensure full recognition of the influence of maintenance procedures and settings. These data must be carefully analyzed. Many staff say they do not have time to keep this data up. This is unfortunate, because with only a little supervision, much could be obtained and charted by work-study students, if other staff were not available.

In practice, this data--or even components of it--are not available unless a particular person on the physical plant staff is assigned the responsibility. Also it is hard to keep tabulating the data, unless its use is continuous. Encouraging maintenance staff to participate in the challenge of moving the chart's trend line down makes keeping the data an integral part of reducing consumption. Data can be kept on a daily, weekly, and monthly basis using whatever levels of disaggregation available. Also, this year's consumption can be charted against last year's. Consumption can be compared during similar temperature periods. Havings bases for evaluation will stimulate the plant staff to make adjustments to mechanical systems, keep up the maintenance, and continually search for ways to reduce consumption--in order to watch for the effect. Having a gauge is important to stimulating professional pride and interest in conserving energy.

At SUNY-Stony Brook, one entire wall of the conference room in the physical plant operations building is taken up with 10 foot long charts showing the last several years' fuel use on a daily basis--it is a constant reminder.

Need for Data for Public Awareness

Efforts to provide the campus community with data on energy usage--especially the consumption savings and high cost--are not numerous. Three of the site visit institutions were attempting to devise a poster strategy, but none had made it operational. At Fairfield University they were considering a technique Amherst College has used: placing a poster in each building telling the estimated annual cost to heat and light that building. At the $50,000 level, it seems that "real money" is backing up the plea to conserve. (See example in Appendix.) At SUNY-Stony Brook, they are trying to design a monthly poster to chart the success in savings the previous month, compared to the year before, not only building awareness of high cost, but also reaching people's competitive spirit. At the University of North Dakota, an energy newsletter was published last winter, with both facts and tips.

Recommendation: The ETF could consider publishing a book of energy charts and poster prototypes. College physical plant personnel could xerox the chart masters, plot their data, and present their staff, the Financial Vice President, President and anyone else with professional tables. Seeing the selection of chart formats would also stimulate collection of data in new ways.

The same publication could also include suggested conservation posters for campus publicity which could be used as is, or personalized to the college and its data. Providing these master copies would eliminate the cost of layout and setup from the physical plant's budget and bypass the need to create a format or find help from the college's public relations department.

Regional Data and Analysis

Many problems--and solutions--are region specific. Likewise national data on energy consumption, costs and weather are of limited use in an individual college management setting. This is particularly true for the trustee or president who is trying to judge the success or failure of the whole energy conservation program.

Recommendation: The Energy Task Force could provide comparative data and analysis and suggested solutions on a regional basis. Analysis by type of institution, or at least building type, would also be helpful. Making information that is specific to the region--its kinds of weather, architecture, and typical plant systems--would be a valuable management tool. It should be stressed here that physical plant operators often have ties to regional organizations, like APPA, through which they receive information and data directly useful in their management operations. The need being covered by this ETF work is for comparative data useful to fiscal officers, presidents, and trustees--in judging the adequacy of their overall conservation efforts vis-à-vis their peers. Also, learning about the techniques and strategies of other campuses with similar energy problems can help the institution set new directions for itself.

Maximize Flexibility in Central Plant Capacity

When designed during the cheap fuel era of the 1960s or earlier, campus energy plants generally comprised several identical large-scale boilers. Many local and state codes require educational institutions to have substantial back-up heating capacity in central steam plants. Therefore, it is not unusual to discover that a college now has 50 to 100 percent more boiler capacity than ever used. Some is required by the state and local codes mentioned above. Some of the excess has been inadvertently achieved by energy reduction measures such as changed temperature settings, new thermalpane windows and insulation. These reduce the overall capacity needed.

Of course, not all boilers must be run concurrently. But if the need for steam is 100,000 pounds an hour and the boilers will each give 60,000 pounds of steam, two must work--and one at much less than its efficient maximum setting. (When a fraction of a boiler's capacity is used, fuel use is much less efficient.) In addition to wasted energy, operating systems below their design specifications, prior to added insulation and windows, can cause equipment failure. Lincoln Land Community College discovered the week of the site visit that the breakdowns they had been experiencing in their boilers for several years were caused by overheated return water. To avoid this problem, heating plants need some combination of boiler sizes. Also, a smaller boiler can efficiently operate in the summer for steam and hot water needs. Nevertheless, major investment in a smaller boiler is a difficult decision to make, particularly if the current boilers are not amortized.

Recommendation: The EDF should consider practical alternatives for colleges with this over-capacity problem. First, they should be sure that colleges understand that they have it. This problem is not on the traditional checklist. Second, alternative boilers and perhaps alternative fuels should be evaluated. Third, methods of financing should be recommended, including determining if there is a market for some used boilers (if not in the U.S., perhaps overseas).

Large Savings Through Efficient Heat and Electric Production

About one-half of all fuels used to generate energy are lost as waste in the conversion or transmission processes. Most is lost in the actual generation of heat and power. Thus, improving the operating efficiency of the plant's boilers and turbines is the most direct and largest way to save on energy costs. Many physical plant operators are alert to their abilities to improve boiler efficiency through routine maintenance, preventive maintenance, adjustments to the amount of air used to burn the fuel, and reduction in stack temperatures. But on some campuses, both large and small, the physical plant people are not aware of methods, or are not given sufficient resources, to maintain the plant at its most efficient capacity. Fuel savings of between 10 and 20 percent are possible through more efficient operation of existing plants. Some capital improvements and modifications could double these savings.

Testing basic boiler efficiency can be easily done through an inexpensive chemical analysis of stack gases and temperature. The actual efficiency of the boiler will depend on its size and design and type of fuel.

Cutting Back on Use of Heat and Electricity

Computer control systems: All of the colleges visited, except the two small private colleges, have some kind of computer control system.

for their heating and cooling mechanisms. Some are quite simple, some are very complex. Some are really just central switchboards, with a canned program set to turn on and off a few times over a 24-hour, seven-day period. These cannot be changed readily or programmed for holidays, etc. Others, such as the one at the University of Texas at San Antonio, not only are capable of operating motors, but also relay temperature and maintenance information to the physical plant office, and control building security and lighting on a detailed basis.

Maintaining someone on staff with the level of computer expertise needed for these systems is a concern. Salaries at colleges are low for this high-priced market. Alternately the institutions can have a software and maintenance contract with a private firm to run the control system.

Other automated control systems: The two small private colleges visited have decentralized boilers. Both have invested in controls for each boiler based on outside temperature readings.

Using Less Electricity for Necessary Lighting

There are as many different philosophies on how to accomplish lower lighting levels as there are colleges. They all agree it needs to be done. But one college will simply remove alternate lightbulbs and leave the extra fixtures vacant. At the next campus, the administrators feel it is unacceptable to have unlit fixtures visible. So they would take the light fixtures out--which they can then keep as replacements for repairs and renovations. Also if the fixture is removed, they know that no one will put a bulb back into it.

Physical plant personnel clearly perceive the strong "habit" factor in lighting preferences, and have tried in various ways to break it. At one college, the physical plant staff went around the campus surreptitiously on weekends to lower the lighting levels, confident that no one would notice the difference Monday morning. On other campuses, each department head was contacted and "hand-held" while the physical plant staff checked lighting levels and adjusted fixtures. On others, the light levels were lowered uniformly and then people could request an upgrade in task areas or for individual preference. In selecting new light levels, most used state guidelines for minimum footcandle levels for various tasks, where once, when the buildings were constructed, "the more light, the better" was the standard.

New Construction

Despite the widespread rhetoric that colleges are not building any longer, on all but two of the campuses visited, new construction is occurring. It may not be at the pace of earlier years, but paces naturally change. In the 1960s, almost all colleges were trying to prepare for larger enrollments. Today, overall enrollments are stabilizing, but individual colleges are growing and student needs are changing. Even constant enrollment does not mean there is no need for new facilities. Worn out buildings must be replaced.

Most campuses put together master plans in the late 1960s. A good example is Fairfield University. Their enrollment is stable. In fact, they are prepared for a slight drop. But they are steadily progressing toward completing their master plan. Right now they are finishing a building that is designated for faculty office space. They identified this structure back in the 1960s as a needed element in their master plan for improving institutional quality. The decision to build is not related to expansion of the campus; in fact, the new building will replace the current use of two small older structures.

New construction today is not necessarily related to making way for new students, more faculty or, in most cases, even new programs. Today, it provides for closing down old, inefficient buildings, and for achieving long term commitments and quality objectives.

In talking to campus adminstrators about their new construction projects, two points became clear. First, they see new construction as a priority target for energy conservation. They want to establish high standards of insulation and ventilation and other design features to ensure lower operating costs for the future. Second, they are frustrated by what they percieve as a lack of real interest and knowledge about energy conservation practices on the part of architecture and engineering firms. It is beyond the scope of this study to determine efficient architectural structures, but clearly this is an area which needs considerable attention--both technically and in communication to presidents, trustees and faculty who make decisions on the design and purchase of buildings.

Recommendation: The ETF should consider ways to stimulate the architecture and engineering professions to be more energy conscious. ETF's responsibility is particularily acute in relation to the educational curricula being offered to future members of these professions. Various strategies are worth considering. Originally, this study had planned to review energy-related consultants. In the course of identifying energy consultants and architecture and engineering firms, it became clear that there are so many, most locally and regionally based, that from a national perspective, judging services was not possible. This same diversity also hinders efforts to acclimate these professions to energy considerations.

Using Consultants

Most of the campuses visited were leary of using consultants to increase energy savings. They would like to be able to take advantage of expert knowledge, but cannot affort to spend sums of money for planning activities that do not have assured payback. They have also been "burned" in the past.

In choosing a consultant, prudent colleges consider these points:

- Can the consultant expert teach the staff to do further analysis?
- How can the inevitable "boiler-plate" analysis be avoided?
- Has a professional colleague used this consultant successfully before?
- What assumptions about fuel costs and inflation rates, etc., will be used? (Specify your own or be sure report includes full description.)

Also:

- Choose a discrete task, fund in steps, so the contract can be terminated if necessary.

Audits: Most of the colleges had, or were planning, energy audits. These can be defined very differently. Fairfield University has an inch-thick hard-bound audit report prepared by a private consulting firm (it contained much "boiler-plate".) [1/] Pomona College was hiring an individual

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1/ In commissioning audits from private firms, be aware that they will work with a formula-driven set of "boiler-plant" descriptions and options. You may get a large, professional book, when what you really need is 15 pages of priorities for action.

consultant to train students to collect data for the audit. Pima Community College had an audit prepared by the State of Arizona. Franklin Pierce College had an audit done in 1976 and is now negotiating with a consultant for a new audit.

At every college visited, the problems of getting good technical expert advise were central to frustrations about energy management, especially at the business officer and presidential levels. Ironically, the less expertise available on campus, the less confident they feel about hiring outside expertise. Spending dollars in energy planning which <u>might</u> find substantial possibilities for reduction is hard to choose over spending dollars for some certain improvement, even if not the best. Thus major universities with much internal talent will hire even more expert consultants, while colleges with staff too small to have energy specialization will not even know how to find expertise. This critical problem should be addressed by finding a way to facilitate getting the expertise to the colleges. Since these colleges do not currently use publications and other resources that are available either, except when trying to solve a particular problem, real assistance would need to be personal in nature.

<u>Recommendation</u>: The ETF should consider what the most potent way to reach small colleges might be--and move to implement that. One idea would be to hire four good technically competent energy advisors who would each be responsible for a region of the country. They would be affiliated with the national associations and offer their consultation services free-of-charge, except for a fee to cover travel. Thus the colleges would get assistance from a trusted source without paying the

full cost of it, which they otherwise would not get at all. The consultant could use sophisticated computer methodologies, suggest products appropriate for the climate of that region and recommend ways to obtain funding. Where possible, a group of nearby institutions, perhaps linked by an existing consortium, could be handled simultaneously. Such a direct consulting arrangement would help the vast majority of colleges much more than publications and computer model applications which only the 200-300 more sophisticated universities use comfortably.

Solid Waste as a Source of Fuel

At almost every campus visited, someone commented that they would like to know about how the garbage that they pay money to haul away might be turned into fuel for their energy plants. Technologies are currently available and being used in several municipalities around the country to produce electricity and steam. The most recent report from the Environmental Protection Agency was made in 1977 (before they turned attention exclusively to hazardous waste). The plants had not been underway long enough to evaluate their effectiveness. (See list in Appendix.) College populations do generate a lot of trash, although probably not enough to fuel their whole facility. Elsewhere, in this paper, the need for small boilers to augment large boiler systems and the need for alternate fuels to handle emergencies have been described. It is possible that these three needs may combine into one viable solution.

Recommendation: The ETF should explore the technology of garbage-fueled steam or hot water boilers (producing about 35,000 lbs. of steam per hour). If feasible, this would provide cheap energy, more flexible boiler capacity, an alternate fuel source for emergencies, and eliminate trash. Possibly, the funds now used for trash disposal could be used to amortize the cost of the project. It is also possible to use tax-exempt Pollution Control Revenue Bonds to fund development. This approach might be especially good, if done in conjunction with an adjacent industry.

Nontechnical Solar Collectors Analysis

A common frustration of chief executives involved in decisions on new construction is the apparent lack of economic feasibility for use of solar collection devices. Even in Tucson, with over 350 days of sun each year, architects and engineers advised Pima Community College against solar collectors for any use. (The college has no dormitories and therefore negligible domestic hot water needs which otherwise might have been a feasible application.) Because there has been a substantial media coverage on solar collectors and other solar applications, it is understandable that there is interest among trustees, faculty and presidents to make use of these technologies, especially in new construction.

But architects and engineers have routinely told the site-visit colleges that solar collectors are not economically feasible yet. Instead they have encouraged installation of fossil fuel systems.

While taking the advice of the experts, these people were left frustrated in their first major effort to produce significant energy savings. Next time, they may be less willing to consider creative ideas, or to question the experts, as they appropriately should.

In addition, these chief executives would like an analysis from an independent source on the feasibility of solar collectors, the appropriate payback figures to be used, and the questions and considerations they might want to take into account.

Recommendation: The ETF could very usefully commission a short analysis entitled "Why solar collectors are not efficient energy sources for colleges and universities."

III. Financing Energy Conservation

While there were many similarities among the colleges visited, they were all different in one interesting aspect. Because of different funding mechanisms, budget structures, and constraints--especially in the public sector--each college has a differing source of "ready" money for energy-saving improvements. Regardless of the advice and perceptions offered here, the commitment and ingenuity of the campus budget officer and the physical plant director will be the determining factors in locating funds and manpower for quick-fix and the numerous under-$100,000 improvements. The president and trustees are the most important actors in identifying larger funding sources. Locating funds outside the institution constitutes an area for which the Energy Task Force could offer considerable assistance, as well as informing the institutions about how to lobby for more state and federal funds to assist in energy conservation.

Funding Within Current Operating Budget

The first place to look for funds to implement energy cost-savings is within physical plant operating budgets. Revised procedures and operating standards may shift the cost components within that budget, improving operating and energy management and prioritizing some funds for energy-related items. The most obvious example is the purchase of 30-watt, energy-saving flourescent lightbulbs, instead of 40-watt, coupled with a reduction in the number of light fixtures in operation, saving both electricity and staff time. By changing lighting standards, product

specifications, and operating procedures, energy conservation takes place and funds are released for other purposes. Another shift in budget priorities should be toward investing in staff development by sending physical plant staff to energy conferences and physical plant association meetings, to give them new ideas, new expert contacts, and a stimulus to improve procedures.

A second priority, closely coupled with the first, is to determine the adequacy of the physical plant operating budget and staff to accomplish conservation. Not only the total dollars should be considered (that must be done in the context of the overall institutional budget priorities), but also the flexibility that the management has to switch funds between line items. Can small capital improvements (energy saving repairs and modifications) be made within the budget on an on-going basis throughout the year? Or must they be separately budgeted and planned ahead? Can staff time be traded for equipment and vice versa? Are certain modes of operation forced on the institution: leasing because there is no capital budget; available funds to purchase services and equipment, but insufficient staff due to a hiring freeze or salary levels below the market for the trades needed?

The chief executive and the budget officer (and state education officials) should evaluate the adaptiveness of the budget procedures and level of funding within which the physical plant operates.

Funding by Leasing

Especially at public institutions, the third option of leasing may be a preferable way to obtain high technology control systems and certain other kinds of energy-conserving equipment. By leasing, funding can come directly from the operating costs savings (if utilities budgets can thus be tapped) with very little upfront cost. If the capital budget is minimal, leasing or lease-purchase may be solutions to procure necessary items. Although not necessarily the least expensive option in the long run, there are advantages. Among these are the ability to replace and update the equipment without hiring or training campus staff, and the ability to terminate the contract if the savings or the service are found unsatisfactory.

Financing Capital Improvements

The fourth source of funding is inclusion of energy-saving projects in the annual capital improvements budgets where they compete with all kinds of other capital needs on campus. At the site-visit institutions, it appeared that energy-related improvements received favorable treatment in their selection from the "wish list" to the final allocation, perhaps receiving roughly one-third of the funds. Also, within any general renovations, careful attention was paid to the energy savings which might be accomplished through the same project. There are two issues to address here:

1. Capital improvements to reduce energy consumption are attractive because they pay for themselves through reduced operating budget needs in the future. From this standpoint all of the [illegible]'s programs

should benefit. But if the energy-saving improvements are competing for the same dollars as are updated equipment purchases for science laboratories or a renovated library and study area, what is the true cost of choosing to invest in energy savings? Proponents of energy savings have the advantage of being able to argue that delaying this improvement for one year will cost "X" dollars; improvements directed at improving program quality generally cannot make specific claims. There are seldom quantifiable measures of the cost of not having an academic program. Are academic needs losing out? Should this be a concern?

2. Because capital improvements for energy savings can be directly related to future cost avoidance with a higher degree of certainty than is the case in many investments, should some funding mechanism be available which takes advantage of this fact--pushing the payments into the future in rightful place of the avoided costs? Thus rather than spending 1981 dollars to save cheaper 1984 dollars, spend 1984 dollars by borrowing. (State and institutional revenue bond issues are an example.) Also because energy capital improvements are being made to save operating costs, there is logic to the argument that the debt be paid out of operating costs rather than by consuming capital which might be directed to the education enterprise explicitly.

There may be some flaws in this approach: chiefly that the energy costs may continue to increase at such a rate that despite decreases in consumption, the college is pressed for funds to cover utility costs. The additional debt expenditure may put greater pressures on the budget or increase tuition. But had the capital expenditure not been made,

the utility expenditure would be even higher. Perhaps a rule-of-thumb of spending one-third of the savings for debt retirement over five years, or one-half the savings over three years would ensure that many of the high payback items could be done efficiently.

Using either traditional or innovative technologies, anything which has a payback period of over five to seven years is not economically prudent considering likely changes in technologies, fuel source availability, and cost. Some experts presume that major breakthroughs are ten years away. If there are major breakthroughs, colleges do not want to be stuck paying off an expensive and out-of-date system--but stand ready to switch gears.

Evaluating Capital Improvements

For each modification that requires capital investment, the administrators must consider the financing and economic feasibility of the measure. Although colleges and universities have heterogeneous characteristics, there are some common finance and investment techniques that can be useful for all institutions of higher education. There are two steps in the investment process:

1) The financial analysis showing whether a course of action is warranted in terms of payback on investment, cost savings, energy conservation and quality-of-life; and,

2) Identification of a source of investment funds.

To determine the economic feasibility of a particular energy modification there are several tools of financial analysis which institutions may utilize.

Model for Estimating Payback Periods: A very useful technique is a model for estimating payback periods. This is fairly simple to create, but many administrators, unless they have hired outside consultants, are currently reinventing the wheel each time they estimate the length of time over which they will pay back a capital investment. Also, a standardized methodology which has passed the review of experts and business officers would assure the staff, presidents and trustees that the analysis was the best possible. Furthermore, administrators would like to be able to doublecheck the payback analysis performed by consulting project engineers.

Obviously, actual payback periods are conditional on crystal-balling energy price increases, but a conservative methodology for short-term paybacks could use current prices--which are unlikely to drop--as the base calculations.

New Sources of Loan Funds

Self-borrowing:Because capital improvements for energy savings have relatively secure paybacks, it might be possible to set up a mechanism whereby the institution could borrow from its true endowment for this purpose, paying back a reasonable rate of return. Or some other form of interfund borrowing might be used, paying back at least what could be achieved in other forms of outside investment. (This has been traditionally viewed as risky.) Alternately, could colleges perhaps form a "pool" of endowment funds to borrow from on a short-term, revolving basis for energy conservation purposes--paying the pool back a rate of return pegged to a national indicator. Aside from questions of

financial feasibility and attractiveness, there may be legal problems to hinder such an arrangement. The endowers of the college expected the principal to be perpetually available, and that should not be jeopardized. However, implicitly they also expected that the college would be operated to maximize funds available for educational purposes. Neglecting reducing energy costs is poor management.

Private Charitable Loan Funds: Private corporations, on a regional basis might be encouraged to create a revolving loan pool of capital available to colleges, hospitals and other nonprofit agencies for energy cost reductions. There is a legal mechanism called a "charitable lead trust" by which the corporations can give a set amount of principal for a period of years--perhaps ten--to a trust for the use of specified nonprofit groups. At the end of the period, the principal is returned to the corporation; the nonprofit groups receive the use of the capital in the meantime. The corporation gets a tax write-off based on the cost of the money for the period. In this fashion, very low interest loans--covering only the cost of administration--could be provided. Payback is reasonably assured, and colleges would be able to spend funds not otherwise pegged for education to get over this surge in energy costs and prepare for the technologies and conditions of the future. 1/

1/ I am indebted to Dr. Stephen Muller, President, Johns Hopkins University, and Dr. Charles Simmons, President, Lake Erie College for the thought from which this strategy germinated.

IV. Comparing Higher Education's Progress to Industry's

Industry is generally regarded as the sector which has conserved the most energy since the 1973 oil crisis. Overall figures do show this, but closer analysis of individual industries indicate that the majority have raised their energy-output ratios. Rather than responding to the oil crisis, there is a long-term trend (pre-1973) toward increased efficiency in production and lower energy use per dollar of gross domestic product. [1/]

Industrial energy usage ranges from miniscule percentages up to 10 to 15 percent of sales for Allied Chemical and Armco Steel. [2/] College usage appears to range from 3 to 9 percent of total expenditures.

ENERGY SAVINGS IN VARIOUS U.S. FIRMS

Firm	Reduction	Time Frame	Comment
Burger King	17%	1974-77	50% by housekeeping
Lockheed (Los Angeles area factory complex)	59%	1972-77	Almost no investment
Tenneco	17%	1972-77	(1) 50% by housekeeping (2) Recycling waste heat
Colgate-Palmolive	13%	1973-76	Mostly housekeeping
Exxon (U.S. refineries)	21%	1972-77	80% with little or no capital investment (11.3 million barrels a year)
Western Electric (Kansas City plant)	38%	1973-77	Almost no investment

Source: Energy User News, April 11, 1977; April 18, 1977; June 13, 1977; October 31, 1977; and February 20, 1978.

Reprinted from: Energy Future, ed. by Robert Stobaugh and Daniel Yergin, Ballantine, N. Y. 1979, p. 193.

1/ See Daniel Yergin, "Conservation: The Key Energy Source", in Energy Future, ed. Robert Stobaugh and Daniel Yergin, Ballantine Books, New York, 1979, pp. 192-194; and Hans H. Landsberg "Energy", in Setting National Priorities, Agenda for the 1980s, ed. Joe Pechman, Brookings Institution, 1980, p. 105.

2/ Yergin, 1979, p. 195.

Examples of Reduced Consumption at Colleges

		# 6 Fuel Oil	Consumption Reduction	Total Cost Increase
SUNY-Stony Brook-Main Campus	78-79	($2.9 m) 8.4 m gallons oil		
	79-80	($4.9 m) 7.5 m gallons oil	-11%	+69%
	80-81	7.1 m gallons oil	- 4%	
			-15% in two years	
		Electricity		
	78-79	($4.5 m) 120 m KWH		
	79-80	($5.7 m) 116 m KWH	- 3%	+16%
	80-81	112 m KWH	- 4%	
			- 7% in two years	

(Electricity in 80-81 back to 1976 levels of usage.)

SUNY statewide reduced total energy consumption FY'73 to'78* 21%, while costs went up 130%. (P. 21) Utilities were 9% of total operating budget.

*Stony Brook's consumption peaked in this year.

Lincoln Land Community College

Gas peak: 1977 at 65,000 Therms/month
1978 at 50,000 Therms/month
1979 at 48,000 Therms/month
1980 at 51,000 Therms/month

Electric airconditioning very high in 1980 to peak of 1,100,000 KWH daily. 1979 was only 700,000 KWH daily.

Pima Community College

55% reduction in gas use since 1977 to 1980

93% unit cost increase in gas, although total dollars spent down.

HAVE REDUCED ACTUAL TOTAL EXPENDITURE.

Electricity: 23% reduction in use 1978-1980.

44% increase in rates

Almost all reduction achieved through "quick fix":
- reduce temperature settings
- turn off unused lights, fans
- security checks window covering positions

In 1978, energy was 2.8% of $19 million budget.

V. National Policy

From an institutional standpoint, holding down increases in the cost of energy, and participating in the national effort to reduce energy consumption are the pressing elements in formulating an energy management strategy and investment program.

From a national standpoint, energy costs are a major contributing factor to inflation rates. Interruption of energy flows and uncertainties about future supplies are potential sources of major shocks to the whole world economy. The Reagan administration's primary energy concern appears to be ensuring the availability of energy, in large part because this helps to keep prices stable. Cutting the rate of inflation and making business investment more attractive depend greatly on reducing the risk of raw materials supply interruptions and reducing uncertainties about future prices. The administration is not going to attempt to keep prices down. If prices rise, consumption does drop, dampening demand, which has a middle term impact on keeping prices lower. The current glut in oil is a good example. Future administration forecasts from the Council of Economic Advisors predict that energy costs will be the same as the general rate of inflation next year and slightly higher--about one percent--for several years after that. The Department of Energy makes price forecasts which are summarized in the Appendix. These forecasts are based on assumptions of increasing energy efficiency and reduced growth in demand, and most importantly--no interruptions in supply. The Reagan Administration's forecasts are essentially banking on a

degree of stability in international affairs that is unlikely to continue. Nevertheless, seeking stability in supply is probably the most important direction for public policy. It allows colleges, industry, and individuals to plan for the future with lower risk.

"If 1979 presages things to come, we are in for rapid change and unforeseen disturbances, projections and prescriptions are likely to have brief life spans; the ability to respond quickly but without panic will carry a premium."[1/]

Department of Education

The Department of Education (ED) should have an interest in keeping the tuition costs at colleges down, but this has not emerged. ED is currently most concerned about reducing federal expenditures for education--period. Providing direct subsidies to college students and colleges is not high on the Reagan agenda, but keeping inflation under control in the cost of college-going ought to be. The ability to send one's children to college is an important American goal. Inflation in college costs is a national concern. With the exception of staff fringe benefits, the fastest growing element in college budgets is the cost of utilities. (See table below.) Curbing utility costs is an

1/ Hans H. Landberg, "Energy, in Setting National Priorities, Agenda for the 1980s, ed. Joseph Pechman, Brookings Institution, Washington, 1980, p. 30.

College and University Energy and Utility Price Indexes: 1971 to 1980
(1967 = 100)

Utility	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Composite utilities index[1]	114.6	122.4	129.0	158.3	202.9	219.1	258.1	292.5	320.8	409.0
Natural gas	109.6	117.0	126.4	142.5	183.6	242.5	364.3	454.8	550.4	745.7
Commercial power	107.8	116.2	122.4	137.0	167.6	181.3	196.9	217.6	224.8	254.9
Residual fuels (heating oil)	150.3	154.3	158.1	323.6	491.5	437.2	470.0	487.2	515.6	814.8
Water and sewerage	130.1	138.5	144.3	152.3	164.4	181.3	200.9	224.4	242.7	253.9

[1]Composite utilities index based on weighted average as follows: natural gas, 20 percent; commercial power, 60 percent; residual fuels, 10 percent; water and sewerage, 10 percent.

SOURCE: U.S. Department of Health, Education, and Welfare, National Institute for Education, Higher Education Prices and Price Indexes, 1978 supplement; Kent Halstead, National Institute for Education, August 1981.

important step in keeping the rate of inflation in education costs down. (Curbing the national inflation rates would be most important since salaries and salary increases are the bulk of college budget concerns.) In efforts to reduce inflation, colleges should link up more fully with the hospital sector, where a strong national interest in curbing costs prevails.

Energy Conservation Loans Under the College Housing Program

Low interest (3%) loans are available for conserving energy and reducing related operating costs under Title IV of the Housing Act of 1950, as amended. Until the creation of the Department of Education (ED) on May 4, 1980, this College Housing program was administered by HUD. Beginning in 1977, in addition to loans for new dormitories and related facilities, Congress authorized that 25% of the annual new loan commitments be for energy conservation; with much urging from the Energy Task Force.

From FY 1977 to FY 1980 (under HUD regulations), $122 million in new 3% interest loans was made available to colleges for renovation and rehabilitation projects to conserve energy and reduce operating costs. There were 225 of these loans made, an average of $542,000 per institution.

The smallest liberal arts college of those visited for this study received in FY 1979 a $209,000 loan under this program. They are just beginning work on replacing the windows and boiler and installing roof insulation and individual thermostatic controls in their largest dormitory.

The Department of Education under the Reagan Adminstration recommended that new loans for the whole program be rescinded in FY 1981 and not established for 1982. However, Congress in July 1981 restored the 1981 loans at about $75 million using funds from the college housing revolving account, meaning that about $19 million is

available for energy conservation. This will be distributed before September 30, 1981. For the whole program, officials expect 200 applications, and expect to make 16 loans for college housing and up to 40 for energy conservation, depending on size of request.

The reasons given by the Administration for eliminating new 1981 and 1982 loans were 1) reduced need because of declining enrollments, and 2) beginning to cut the debt obligations of the revolving fund to the Federal Financing Bank. Only $10 to $14 million a year in new appropriations to college housing showed up prior to 1981 in the federal budget. But the Administration estimates annual off-budget interest costs to be more than $200 million--to support the $3 billion in subsidized loans made since 1950. [1/] Therefore, to begin to reduce this burden, the Administration wanted to use the repayments to the revolving fund and stop making new commitments. However, the College Housing Program is quite popular. Congress reinstated the 1981 loans at about $75 million--$10 million less than the 1980 level--wholly out of the revolving fund. This protects the goal of reducing on-budget expenditures.

Appropriations and funds for new loan commitments are not expected in FY 1982, but higher education governmental relations experts are somewhat optimistic that of all "zeroed-out" programs, this could emerge with a 1982 allocation, particularly if limited to use of the revolving fund assets. The Congressional appropriations process will not be completed until September 1981.

[1/] Department of Education, Justifications of Appropriations Estimates for Committee on Appropriations, Fiscal Year 1982, Revised, U.S. Government, mimeo, (no date).

Pursuant to taking over the College Housing Program, the Department of Education developed new regulations. Although, as explained above, new loan commitments were not originally expected to be made in 1981, planning proceeded. After Congress acted, regulations and procedures were quickly published in the Federal Register, July 29, 1981 (pp. 38880-38890). NACUBO sponsored a conference in February 1981 to give 170 college and university administrators an opportunity to suggest improvements to the new ED administrators of the housing program. Many of these recommendations were incorporated into the program. Interest was also expressed in developing and maintaining a data base on the recipients of loans, in part cataloging the success of energy conservation innovations. HUD's record-keeping techniques make collection of past years' data difficult. NACUBO's Facilities Committee also is considering studying this program.

Within the new ED regulations, applicable improvements are openly defined and include new windows, insulation, siding, boilers, and any other physical improvements to conserve energy. Applications will be evaluated in terms of the amount of savings in annual operating costs and the briefness of the payback period. Thus awards will be based on judgement of the amount of savings to be achieved, the likelihood that savings will occur, and the fastest return on investment. The new regulations have as a standard that repayment terms be based on the projected "payback period" of the operating savings plus two years. Of special interest is the requirement that colleges affirm they have already implemented various standard conservation measures in the manner shown in the following exhibit, based on earlier ETF materials.

College Housing Program

Minimum Conservation Measures

In connection with projects intended to conserve energy, the applicant must indicate that minimum energy conservation measures have been accomplished. Completion of the following checklist will indicate the extent to which this requirement has been met:

Code

1 = No (no considerable involvement in this activity)

2 = Yes (considerable involvement in this activity)

3 = N.A. (not applicable)

Specific temperature ranges and thermostat settings:

- ☐ 65°–68°F Winter
- ☐ 75°–80°F Summer
- ☐ Reduction in illumination levels and lamp wattage
- ☐ Substantial night and weekend building shutdowns
- ☐ Consolidation of activities into fewer buildings, particularly during evenings and weekends
- ☐ Development of energy efficient space allocation practices
- ☐ Scheduling of institutional vacations during energy intensive periods
- ☐ Restrictive policy on appliance usage
- ☐ Restrictive policy on air conditioning installation
- ☐ Reduction of domestic hot water temperature
- ☐ Manual reduction of fresh air makeup
- ☐ Manual monitoring of buildings
- ☐ Work schedule adjustments to maximize daylight working hours
- ☐ Reduction of building heat leakage by using blinds and drapes

Maintenance review of existing energy systems:

- ☐ Inspection and regularized maintenance of steam traps
- ☐ Inspection and correction of valve functions and air filtration systems where needed
- ☐ ORSAT analysis of flue gases

Total involvement of institutional community:

- ☐ Faculty, staff, and student energy committee
- ☐ Appointment of building energy monitors
- ☐ Energy briefing sessions with building occupants
- ☐ Campus-wide energy awareness programs

If the answer to any of the above is "no," please attach a brief explanation.

(Source: Federal Register, Vol. 46, No. 145, July 29, 1981, p. 38890)

Recommendation: Colleges are not routinely aware that some college housing loan funds are set aside for energy improvements. Considering the limited number of awards, expensive publicity and encouragement to apply may not be appropriate. Nevertheless, the potential of these funds should be considered as part of an overall package of loan possibilities to be promoted.

Recommendation: The Energy Task Force should consider the emphasis it should place in its lobbying efforts on ensuring FY 1982 and future years' loan availability. Also, it might be argued that new legislation should provide that more than a 25 percent share of funds be available for energy conservation and cost reduction. Reasons are that:

- more colleges could be helped with limited funds,
- national goals of energy conservation, lower demand and lower prices for all would be assisted, and
- fiscally strapped colleges could keep tuitions lower.

Recommendation: With 225 projects funded to-date, it should be possible to review and evaluate the spending of these funds. Such an evaluation, even if cursorily accomplished, could provide useful background for efforts to stimulate more loan funds from public and private sources.

The ETF would be an appropriate sponsor of such a review. Before undertaking the study, it should be determined how many of the projects are completed. Though funds are obligated in the year commitments are made, completion of a construction project may take several years--recording of energy savings a year or two longer. In fact, it may well be that the practical effects of those loans dispersed in 1977 are just beginning to be fully experienced.

Particularily since stimulating loan funds is likely to be an ETF priority, these projects should be reviewed for the lessons to be learned. It might also be helpful to review the unsuccessful applications (probably 500-600) to find out whether the colleges went ahead and found other funding for the projects.

Other Loan Possibilities

Title VII of the Higher Education Act contains a provision for facilities loans for energy conservation, but it has never been funded.

The Department of Energy loan program for colleges and hospitals is up for Congressional reauthorization and is in severe jeopardy. The General Accounting Office recommended that the energy audit portion be retained, but that facilities loans not be given. Even this retention is unlikely, with future initiatives being left up to the states, or perhaps limited to a loan guarantee. (The states may do a good job, they certainly have a vested interest in savings in the public college sector, and tax-exempt revenue bonds can be used to create funds.)

Perhaps the federal government might be approached to provide an additional tax incentive to corporations which set up revolving loan funds to help colleges retool for energy savings. Since most of these capital improvements involve purchase of equipment and services, this would also be an investment in the stimulation of the whole economy.

APPENDIX

CAMPUS PUBLICITY IDEAS

Brochure to everyone under President's name (Fairfield)

Sign posted in each building showing:

Annual "whopping" utility cost of that building (Amherst Co.-from Fairfield)

Monthly posters of energy consumption and costs for previous month (Stony Brook)

Signs to "turn off lights" on switchplates (everywhere)

Dormitory contests for reduced consumption (Chatham)

Newsletter inserts (common)

Energy newsletter (North Dakota)

CONSERVE

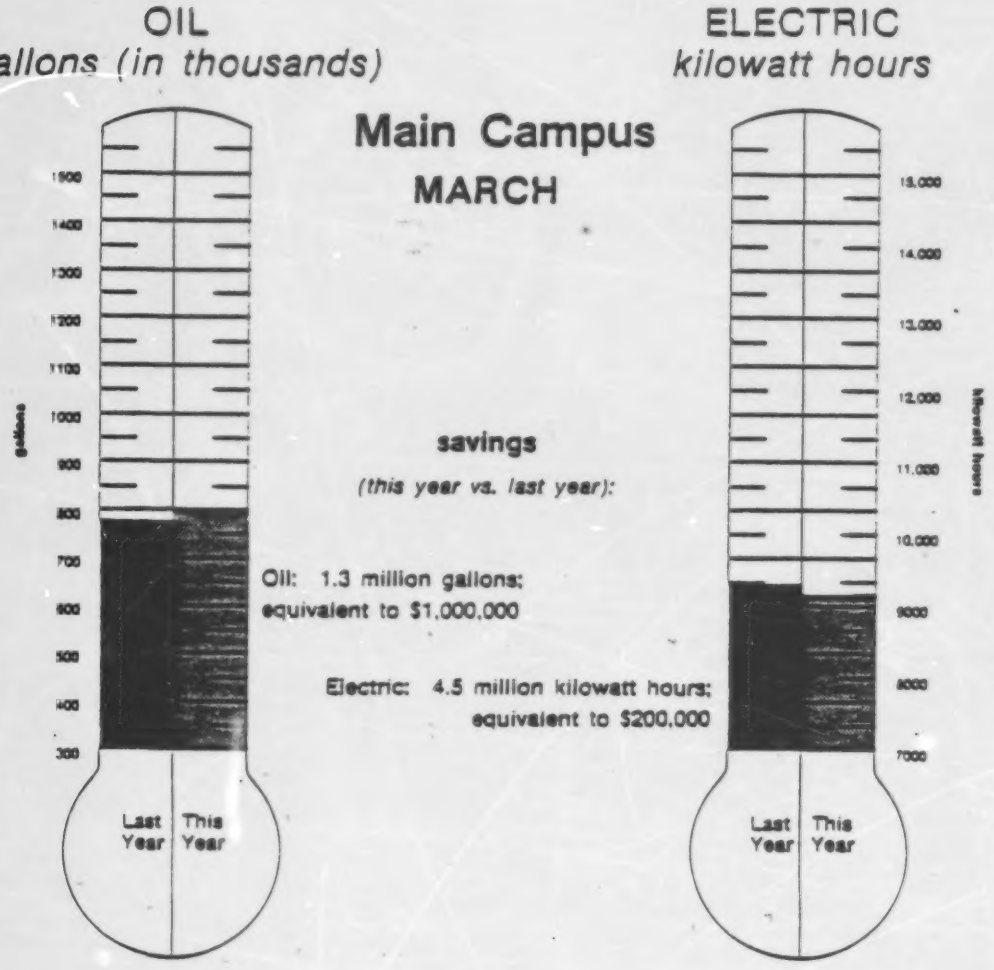
THE ESTIMATED ENERGY COST OF THIS BUILDING DURING THE CURRENT ACADEMIC YEAR

HEAT	$ 32,970
ELECTRICITY	$ 15,385
WATER	$ 2,930
TOTAL	$ 51,285

CONSERVE!
AT AMHERST

Stony Brook

CAMPUS ENERGY CONSUMPTION*



OUR "ENERGY TEMPERATURE" IS GOING DOWN

*Adjusted for heating and cooling degree days

ETF ENERGY MANAGEMENT NEEDS PROJECT

METHOD OF SELECTING SITE VISIT INSTITUTIONS

The colleges and universities at which the interviews were conducted have been selected and form a well-balanced group of American colleges on a number of criteria, including public/private control, level of educational offering, enrollment size, energy characteristics, residential characteristics, and governing and budgeting characteristics.

The ten colleges and universities to be visited were selected by building composites of institutional characteristics which should be represented, such as "typical private liberal arts college, enrollment under 1,000, no especially sophisticated energy features, uses heating oil, residential, located in climate belt 1." Having created ten composites, institutions which fit the characteristics were picked from a variety of printed directories and listings. The selected colleges' APPA members and/or Directors of Physical Plant have been called to provide a quick sketch of the energy services and energy conservation techniques used by the college and, if a public institution, to determine whether there was a budget-saving incentive. Some adjustments were made to provide a balanced selection of colleges.

Of special interest is the fact that we were able to draw on work of the Higher Education Panel completed during their 1976 survey on energy costs undertaken with the Energy Task Force. The chart below shows regional climate bands of the United States based on 30-year averages of the sum of heating and cooling degree-days. One of the selection factors was location within climate bands in rough proportion to the number of colleges within the region.

CLIMATE BANDS		INSTITUTIONS #	INSTITUTIONS %	SITE VISIT INSTITUTIONS
East	1	246	8	1
	2	539	18	3
Midwest	3	454	15	1
	4	357	12	1
South	5	429	14	1
	6	501	17	1
West	7	115	4	0
	8	155	5	1
	9	191	6	1
Total Institutions		2987	100	10

SITE VISITS

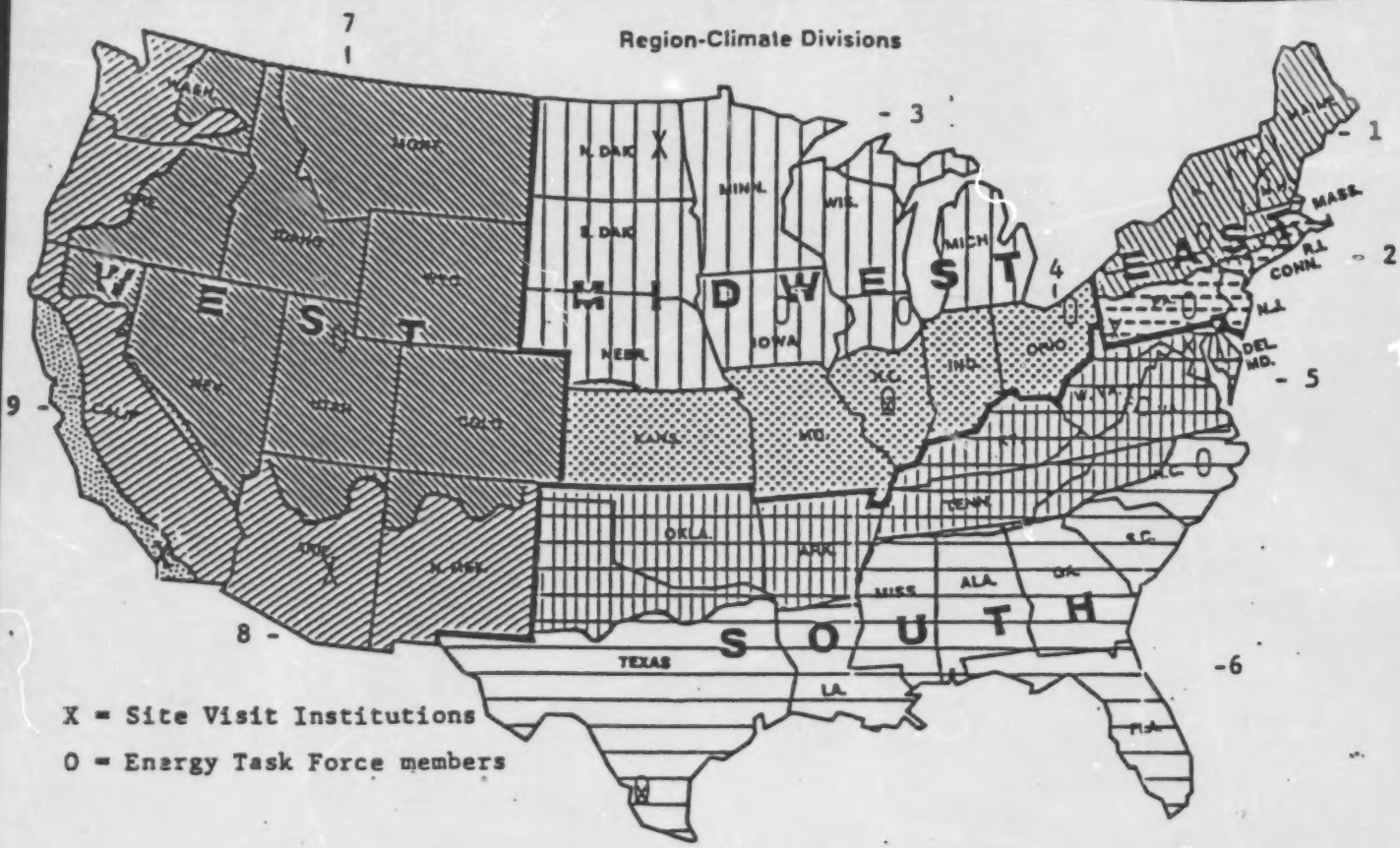

Region-Climate Divisions
7
1
- 3
- 1
- 2
4
1
- 5
9 -
8 -
-6
WEST
MIDWEST
EAST
SOUTH
WASH.
MONT.
N. DAK.
MINN.
WIS.
MICH.
N.Y.
MASS.
R.I.
CONN.
N.J.
DEL.
MD.
IDAHO
WYO.
S. DAK.
NEBR.
IOWA
ILL.
IND.
OHIO
W. VA.
KY.
CALIF.
NEV.
UTAH
COLO.
KANS.
MO.
TENN.
N.C.
OKLA.
ARK.
MISS.
ALA.
GA.
S.C.
N. MEX.
TEXAS
LA.
FLA.
X = Site Visit Institutions
O = Energy Task Force members

TABLE 22

FINANCING AND PROCUREMENT APPROACHES FOR LARGE-SCALE RESOURCE RECOVERY PLANTS CONTRACTED FOR SINCE 1967[a]

Location	Financing method	Procurement method	Project management	Type	Capacity (tons/day)	Market
Systems in operation:						
Ames, Iowa	City GO bonds	A&E	City	RDF	400	City-owned utility
Harrisburg, Pa.	Revenue bonds	A&E (partial turn-key)	City	WWC	720	Steam heating loop
Nashville, Tenn.	Revenue bonds	A&E	Nonprofit corporation	WWC	720	Steam heating and cooling loop
Norfolk, Va.	U.S. Navy appropriation	A&E	U.S. Navy	WWC	360	Steam, Navy base
Saugus, Mass.	Pollution control revenue bonds	Full-service (industry initiative)	Private corp.	WWC	1,200	Steam, industrial plant
Systems under contract:						
Baltimore, Md.	Federal grant, State loan, city funds	Turn-key	City	Pyrolysis	1,000	Steam heating loop
Baltimore County, Md.	State reimbursable county GO bonds	A&E	Private corp.	RDF	550	Cement plant
Bridgeport, Conn.	State revenue bonds (moral obligation)	Full-service	Private	RDF	1,800	Materials industries, utility
Chicago, Ill.	City GO bonds	A&E	City	RDF	1,000	Utility
Dade County, Fla.	State GO bonds	Full-service	Private corp.	WRDF/WWC	3,000	Utility, materials industries
Hempstead, N. Y.	Pollution control revenue bonds	Full-service	Private corp.	RDF, WWC	2,000	Utility, materials industries
Milwaukee, Wis.	Private	Full-service	Private corp.	RDF	1,000	Utility, materials industries
Monroe County, N. Y.	State grant, public improvement bonds	A&E (partial turn-key)	Private corp.	RDF	2,000	Utility
New Orleans, La.	Private	Full-service	Private	RDF	650	Materials industries
St. Louis, Mo.	Pollution control revenue bonds	Full-service	Private	RDF	6,000	Utility

[a]Resource Recovery Division, Office of Solid Waste, EPA.

Abbreviations and definitions: RDF = refuse-derived fuel system; WWC = waterwall combustion; WRDF = wet-pulped refuse-derived fuel; GO = general obligation; A&E = architect and engineers perform feasibility study, design facility, supervise equipment bidding; turn-key = contractor designs, constructs, and guarantees performance of facility to meet acceptance tests; full-service = contractor designs, builds, and operates facility.

Reprinted from: Office of Solid Waste, Fourth Report to Congress: Resource Recovery and Waste Reduction, U.S. Environmental Protection Agency, Government Printing Office, 1977, p. 60.

Needs Associations Can Meet

-- find and publish more case studies

-- get CFAE to do ads suggesting giving dollars to colleges for energy improvements

-- items in the respective association journals would clearly be the best way to reach nonphysical plant administrators

-- ideas for using garbage as fuel

-- need to have examples and data by region

-- lobbying for government assistance

-- locate loan dollars

-- product endorsements

-- provide trained energy experts as consultants and advisors

Government Services

Various free energy services are provided by the Department of Energy (DOE). The most widely known DOE service is the National Energy Information Center which provides statistical information and referral assistance for government agencies as well as the industrial, commercial, and academic communities. The Solar Energy Information Data Bank is a national information network for solar energy that responds to public inquiries. In addition, DOE distributes pamphlets, booklets and kits of materials on energy subjects. A speaker's bureau will make arrangements for DOE staff to speak throughout the country.

There are also state energy offices and extension services throughout the United States which often supply assistance, speakers, publications, workshops and audio-visual materials.

Learning the Ropes

Any administrator, general or physical plant, who wants to gain a comprehensive knowledge of energy conservation possibilities, can go to a number of sources. Energy Management for Colleges and Universities (ETF, NACUBO, 1977) is a comprehensive 140-page manual which can be read and absorbed usefully by a person in any administrative position. Several general manuals are put out by commercial enterprises. A home study course, using a programmed text format, is also being prepared. Workshops are also available through APPA and other providers.

Local utility companies, and state and regional physical plant organizations and vendors all have conferences and seminars on energy conservation periodically, as well as continuously providing information and a forum for sharing problems and ideas.

Literature and Services Review

by Cecilia Mitchell

Much good literature has appeared on the subject of college energy planning and management. References to these appear in the bibliography and selected annoted bibliography of the main report. This section synthesizes these contributions and provides the bibliographical references for those who seek more in-depth knowledge in specific areas.

Colleges and universities today are faced with myriad of problems that threaten their budgets and fiscal long-range planning. Adjusting to skyrocketing energy prices is a management problem that has continued to grow in importance since the 1973-74 oil embargo. Currently, institutions of higher education are faced with rising operation and and energy costs, often within tightening academic budgets. According to Lawrence Landry, Vice President and Treasurer of Swarthmore College and 1980-81 chair of the Energy Task Force, the utility costs which previously were 15 percent of the buildings and grounds budget are now 35 percent and could escalate to 50 percent in the future. Landry further states "that of the institution's total budget, energy averages six to ten percent depending on location, schedule and type of fuel."[1/]

1/ Lawrence Landry. "How Swarthmore Saves Energy." AGB Reports 22,6 (November-December 1980): 26.

These constricting factors of escalating energy prices, rising operation costs, and tightening academic budgets have compelled institutions of higher education to become creative in finding ways to reduce energy use and control energy costs.

Based on the reports in the literature in the 1970's, colleges and universities utilized a number of strategies to decrease their energy consumption. Most institutions implemented procedures to eliminate the most obvious energy wasters. Such "quick fix" measures of turning off or removing unneeded lights, shutting down heating/cooling systems on nights and weekends, and reducing hot water flows are examples of the strategies which are used. Although these initial steps are estimated to have decreased consumption 10-15 percent, there remains a need to reduce consumption further. The site visits have shown that colleges are making further reductions, some dramatic.

There are some institutions which not only implemented these quick fix measures but also developed a comprehensive evolving long-range plan to conserve energy. In view of the ever-increasing energy expenditures and other budgetary constraints confronting colleges and universities, an energy conservation program is a necessity. According to Albert Thuman, P. E. (1977), "the problem facing management is how to organize the energy conservation activities so that all functions are moving in a common direction."[1/] As is evident from the vast

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1/ Albert Thuman. Plant Engineers and Managers Guide to Energy Conservation. New York: Litton Educational Publications, p. 255.

amount of literature, the two most important issues facing college and university administrators are:

1) how to establish an effective energy management program, and
2) how to establish a permanent energy-conscious management structure within the institution.

Energy Management Plan

An energy management plan coordinates the technical, management and human systems which impact upon the campus' energy consumption and expenditures. However, colleges and universities are faced with some unique energy management problems. Experts have identified institutions of higher education as "simultaneously, diverse, decentralized, and transient in their energy usage, possessing limited cost pass-through opportunities."[1/]

College campuses are characterized by diverse building designs, engineering systems, age and function which require individualized approaches to energy conservation. Such diversity complicates the energy strategy. To further complicate the plan, higher education's management and structure of demand are considered in the literature to be decentralized, with the use of energy dependent on individual consumption patterns. The site visits did not show much evidence of this. The ability to control energy use appears to be technically

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1/ Energy Management in Colleges and Universities, NACUBO, 1977, p. xiii.

centralized. In addition, the transience of college and university students exacerbates the difficulty of developing a comprehensive plan. Finally, campuses are unable quickly to pass increasing energy costs to their "consumers," due to their 12-18 month budget cycles, and aggregate structure of most operating budgets.

These factors make any approach to energy problems a task requiring creativity and individualized planning. Although each college and univesity has varied needs there are several common elements which institutions should consider when developing an energy management program.

As mentioned in several publications (Kruza 1979; Kaiser and Parker, 1981), one of the most essential ingredients of an energy conservation plan is top management commitment. Administrators must have an ongoing commitment to energy conservation as a high priority if the institution is to implement the plan. The concern and commitment of the top administration will serve as a leadership model for others within the campus community. A successful energy management program needs input and participation from all levels of a particular institution.

Appoint an Energy Coordinator

One manner in which committed top management can change the energy consumption patterns of their institution is to appoint an energy manager or coordinator. The energy coordinator will provide the necessary leadership and direction which is required to achieve a responsible and responsive energy program. The energy manager must

possess technical and managerial skills and also have familiarity with the special energy problems of institutions of higher education. This individual must be capable of developing, administering, and coordinating an overall energy management program (Stenzler, 1979). The manager's main responsibilities are to supervise energy audits, analyze energy usage data, establish and maintain a data base, and provide energy information and expertise for institutional planning, renovation and expansion. He or she will also implement energy conservation measures and projects.

Energy Action Committee

The next important aspect of an energy plan is the establishment of an energy action committee. This group should be representative of the administration within each of the divisions: maintenance, planning and construction, plant operation, transportation and food service. There should also be representation for the faculty, student body and an energy specialist (Jones and Steinbrink, 1980). A diverse membership ensures input from all areas and enables more people to become committed to the cause and to generate more ideas. With the energy coordinator as resource, members of the energy committee will collect the initial energy use data.

Mini-Energy Audit

The mini-energy audit is a preliminary walk-through survey. "it is an inexpensive way for an institution to acquire an independent

assessment of the energy effectiveness of campus buildings."[1/] The mini audit can also determine the need for more detailed analysis of the structures.

According to Kenneth Kogut, P. E., the areas analyzed in a mini-energy audit are:

1) an examination of the utility buildings;
2) inspection of the structures' lighting system;
3) examination of the buildings' major energy loads for application of loan management techniques;
4) examination of the buildings' shells or envelopes; and
5) examination of the heating, ventilating and air conditioning (HVAC) systems.

This audit further identifies the energy consumption characteristics of buildings, which includes the function, size, rate and type of energy used, fuel cost data, age of the buildings' parts and the floor plan. On the basis of the findings from the audit, recommendations on modifying the structures' energy systems and operating procedures are made. This audit may also identify the need for a more detailed audit. If regular staff are not available, students could be trained to undertake these mini-audits, as they are being done at Pomona College.

[1/] Kenneth J. Kogut. "The Mini-Energy Audit." School Business Affairs 47,7 (June 1981): 9.

Detailed Energy Audit

Following the mini-energy audit, it may be necessary to perform a more detailed analysis. With the use of an engineering or architectural consultant a complete detailed analysis of the physical plant and its operating systems, use patterns and historic energy consumption data are used to determine the potential for energy savings. According to Jack Probasco in a recent article entitled, "Energy Management: Past, Present and Future," a building during a detailed audit is generally analyzed by looking at three components: the active systems, e.g., fans, pumps and lights; the passive or structural systems such as the walls, roof and glass, and the human component which includes the maintenance and operation of the building, occupancy patterns, and the internal arrangement of the rooms.[1/] After inspecting and examining the various systems and energy use data a final report is written. This report should include:

1) a complete inventory of energy using equipment,
2) the building's calculated energy budget,
3) current deviations from the calculated budget,
4) energy and cost savings as a result of implementing the recommendations, and
5) capital investment and payback period analysis for the recommended refit and systems convert measures.[2/]

1/ Jack Probasco. "Energy Management: Past, Present and Future.: School Business Affairs 47,7 (June 1981): 12.

2/ Yale Steinzler. "Energy Conservation: How to Get Organized." American School and University 51, 6 (March 1979): 67S.

This final report becomes the institution's energy master plan which identifies specific and measurable long- and short-term strategies, ranks the possible actions and identifies methods and guidelines for monitoring and evaluating the program once in progress. It should be noted that the energy master plan, like the college or university, is not static but dynamic. It should be re-evaluated and changed to reflect new technologies and problems.

Evolutionary Approach to Energy Management

Once the analysis is completed and the master plan developed, the identified conservation measures are implemented by appropriate campus staff. An effective strategy for the implementation is an evolutionary approach which is a "well-planned and coordinated program, moving from the most elementary steps to levels of increasing sophistication (NACUBO, 1977)." There are three phases of the evolutionary approach:

1) quick-fix measures,

2) retrofit modifications, and

3) systems convert measures.

Quick-fix measures are energy reduction modifications which can be implemented rapidly at little or no cost. These modifications for most institutions of higher education usually result in energy savings of 10 to 15 percent. Several examples of quick-fix measures are: reduction of lighting; using timing devices to "shut down" or set back" a building; caulking of cracks in the building's exterior and interior.

Retrofit modifications are the second phase of an evolutionary approach. Retrofit measures usually require a modest capital investment of twenty-five cents to one dollar per gross square foot (Probasco, 1981) and provide a payback of six months to five years depending on the measure involved and the capital invested. Furthermore, these strategies will produce an additional energy savings of 10 to 15 percent. Due to the budgetary constraints experienced by colleges and universities it would be wise and it is necessary to prioritize the retrofit measures. The most likely retrofit modifications to impelent first are those which provide the fastest payback in energy savings (NACUBO, 1977). Based on this standard, the most likely systems to be targeted are those which operate 24 hours a day, particularly those which are large energy users, such as basic heating and cooling systems.

Some effective retrofit measures implemented by colleges and universities are implementing air volume reductions, using outdoor air for cooling, modifying lighting controls, fixtures and space characteristics, improvement in building utilization, refinement of the heating, ventilating, and air conditioning systems (HVAC).

The final phase of conservation measurs is systems convert, the most complex and sophisticated level of modifications. These measures require major alterations and capital expenditures in which the cost range from seventy-five cents to four dollars per gross square foot (Probasco, 1981), and usually provide an additional energy savings of 10 percent. These modifications may not be appropriate...for many colleges, however, research institutions and those providing health

care are energy-intensive and, therefore, should review systems convert options.[1/] Systems convert measures have a normal payback of five years or more. Examples of systems convert modifications are:

1) installation of heat recovery systems,
2) installation of central computerized controls and monitoring systems,
3) conversion of the primary boilder and solar energy utilization.

Since energy conservation is an evolutionary process, institutions of higher education should not attempt to implement the various modifications immediately but ponder the issues and decisions deliberately and carefully so that energy savings can be attained and maintained effectively.

[1/] Energy Management in Colleges and Universities. NACUBO, p. 44.

Sources of Information for Contingency Planning

Any energy conservation strategy must deal with the threat of embargoes and emergency fuel supply interruptions. An important component of any energy management program is the development of a contingency plan for operating in the event of adverse conditions.

In order to formulate the college's contingency plans it is necessary for the energy committee and energy coordinator be familiar with knowledge of the national policies, the local supply picture and also to be aware of the changing picture (e.g., further sources of energy, technological improvements, and alternative sources). There are several sources which may be useful in determining the future of the energy situation and can be used as a starting point for an institution's contingency plans. The most comprehensive and probably the most useful source of information are energy directories. From these directories one is able to identify organizations, government agencies, indexes and journals or newsletters that can provide the latest information.

Anocher source which would certainly be useful are Energy Extension Service programs which are located in almost every state. These programs provide conservation information, brochures, a speaker's bureau, workshops and information referral. The extension service also has information on the local energy situation.

Although there is a vast amount of information concerning the future of energy and the impact it will have on our national planning very few of the college and university administration journals discussed in detail the importance of developing a contingency plan. Perhaps this is reflective of the fact that very little attention has been given to this matter.

Energy Forecasts

by Cecilia Mitchell

According to the Energy Information Administration (EIA) in its 1980 report to Congress, the preponderant factors which have an effect on energy consumption in the commercial sector (i.e., educational facilities, retail/wholesale establishments, office buildings and warehouses) during the midterm are energy prices, economic growth and government programs.

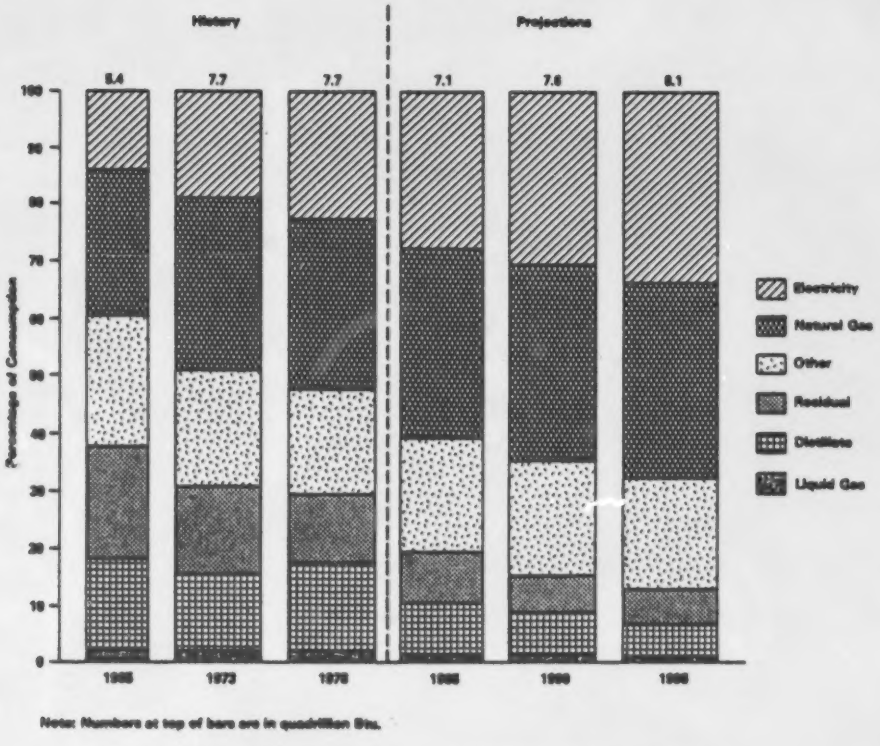
The midterm forecasts presented by EIA cover the period from 1978-1995. The information is presented in terms of change between 1978-1985, between 1985-1890, and between 1990-1995. This chapter focuses primarily on forecasts between the present and 1985, an important planning period for higher education's senior administrators.

The commercial sector's overall energy consumption is expected to decline from 1978 to 1985. In 1978, this sector consumed 7.7 quadrillion BTU's and is expected to decrease to 7.1 quadrillion BTU's in 1985 (see Table 1). The projected decrease, according to EIA, is a result of the substantial energy price increase during the period of 1973-1978, as well as the delayed effect of low disposable income growth.

There is an expected decline in the annual consumption rates of most fuel sources during the period 1978-1985. Distillates [1/] have the largest forecasted reduction in consumption for this period. The annual rate of consumption for distillates increased 1.15% from 1973-1978 compared to a 7.58% decrease for the projected period of 1978-1985 (see Table 2). As reported by the EIA, the dramatic decrease in oil consumption can be attributed to the escalating price of oil and the growth of electricity use in the commercial sector. Distillate prices are forecasted to increase at a rate of 10.64% during the period 1978-1985 which is quite high when compared to the rate for electricity (4.35%).

[1/] No. 1 and No. 2 heating oils, diesel fuels, and No. 4 fuel oil.

Table 1



Note: Numbers at top of bars are in quadrillion Btu.

Commercial Energy Fuel Shares by Source, 1965–95, Middle World Oil Price

Source: Energy Information Administration, 1980 Annual Report to Congress, Volume Three: Forecasts, U.S. Department of Energy, Government Printing Office, p. 60.

Table 2

Energy Consumption and Prices in the Commercial Sector: Compound Annual Growth Rates, 1965–95

(Percent)

	History[a]		Projections			
Fuel	1965–73	1973–78	1978–95	1978–85	1985–90	1990–95
Electricity	6.43	3.44	2.62	1.91	3.13	3.13
Price	-3.24	3.96	1.73	4.35	-0.07	-0.06
Distillate	2.36	1.15	-5.16	-7.58	-3.52	-3.32
Price	0.35	10.45	6.08	10.64	2.11	3.89
Residual	2.34	-3.07	-4.63	-6.38	-3.90	-2.95
Price	3.93	9.12	7.29	14.95	2.09	2.37
Liquid Gas	6.34	-3.28	-0.75	-1.54	0.27	-0.66
Price	1.75	7.51	6.20	11.27	1.99	3.59
Natural Gas	7.46	-0.06	0.93	-0.28	2.31	1.26
Price	-1.22	10.45	5.50	10.77	1.36	2.55
Other	1.39	-1.70	1.10	0.91	1.50	0.96
Total	4.61	0.03	0.29	-1.11	1.36	1.19
Average Price	-0.50	7.75	3.91	7.26	1.27	2.00

[a]Sources of historical data are (1) *State Energy Fuel Prices by Major Economic Sector, 1960–77, Preliminary Report and Documentation*, July 1979, DOE/EIA–0190 and (2) *State Energy Data Report*, Statistical Tables and Technical Documentation 1960–78, DOE/EIA–0214(78).

Source: Energy Information Administration, 1980 Annual Report to Congress, Volume Three: Forecasts, U.S. Department of Energy, Government Printing Office, p. 64.

As the use of distillates decreases, the use of electricity increases. Electricity consumption is not forecasted to reach its pre-embargo annual growth rate (8.43%), however, the rate of increase in electricity use is expected to decrease by nearly 45% (see Table 2) in the forecasted period 1978-85, but begins to increase moderately after 1985.

The price of electricity during the midterm is projected to increase at a gradual rate from 1978-85 (4.35%). It is expected to decline significantly, however, in the period 1985-90 (-0.07%).

Residual[1/] fuel use is also projected to decline considerably during the midterm period of 1978-85. The consumption rate in 1973-78 decreased 3.07% and is expected to decrease by 6.33% over 1978-85. However, it is forecasted that residual fuel consumption will increase after 1985 as the prices decrease considerably.

During the forecast period 1978-85, national consumption of gas is expected to decrease while the price increases (see Table 2). This trend is projected to reverse itself dramatically from 1985-90, with a consumption rate increase of 2.31% and a price increase of only 1.36% in that period.

The consumption of other fuels, which include asphalt and coal, is expected to increase moderately between 1985 and 1995 (see Table 3).

According to the EIA, rising energy prices during the midterm encourage the adoption of energy saving measures. This prevailing tendency has been reinforced by government programs (e.g., grants to schools and hospitals) designed to promote the efficient use of energy and to encourage institutions to retrofit existing structures.

[1/] Topped crude oil, including No. 5 and No. 6 fuel oil.

Table 3

Commercial Energy Consumption and Prices: History and Projections for Three Base Scenarios, 1965–95

(Quadrillion Btu and 1979 Dollars per Million Btu)

	History[a]			Projections								
	1965	1973	1978	1985			1990			1995		
Fuel				Low	Mid	High	Low	Mid	High	Low	Mid	High
Electricity[b]	0.76	1.46	1.73	1.98	1.97	1.95	2.33	2.30	2.28	2.76	2.68	2.66
Price	13.77	10.58	12.84	17.07	17.30	17.52	16.87	17.24	17.60	16.71	17.19	17.40
Distillate	0.88	1.06	1.12	0.67	0.64	0.61	0.59	0.54	0.50	0.53	0.45	0.41
Price	2.15	2.21	3.63	6.59	7.37	8.38	6.65	8.18	9.57	6.72	9.90	13.06
Residual	1.00	1.21	1.03	0.69	0.65	0.62	0.59	0.54	0.50	0.54	0.46	0.41
Price	1.17	1.59	2.46	5.80	6.53	7.46	5.83	7.24	8.50	5.84	8.14	10.25
Liquid Gas	0.09	0.15	0.13	0.12	0.11	0.11	0.12	0.11	0.11	0.12	0.11	0.10
Price	2.19	2.51	3.61	6.85	7.62	8.68	6.85	8.41	9.75	6.85	10.03	13.04
Natural Gas[b]	1.35	2.39	2.39	2.37	2.34	2.35	2.62	2.62	2.63	2.83	2.79	2.80
Price	1.55	1.41	2.31	4.60	4.73	4.66	5.08	5.06	5.01	5.63	5.74	5.69
Other[c]	1.29	1.44	1.32	1.41	1.40	1.40	1.52	1.51	1.51	1.61	1.59	1.58
Total[d]	5.36	7.69	7.71	7.25	7.13	7.04	7.76	7.63	7.53	8.38	8.09	7.96
Average Price	3.92	3.77	5.48	8.52	8.94	9.34	8.90	9.52	10.04	9.36	10.51	11.46

[a]Sources of historical data are (1) *State Energy Fuel Prices by Major Economic Sector*, 1960–77, Preliminary Report and Documentation, July 1979, DOE/EIA–0190 and (2) *State Energy Data Report*, Statistical Tables and Technical Documentation 1960–78, DOE/EIA–0214(78).

[b]Master metered apartment consumption has been transferred to the residential sector.

[c]Asphalt and Coal are included in "Other." In 1978, asphalt accounted for approximately 1.2 quadrillion Btu and coal, 0.2 quadrillion Btu.

[d]Renewable resources (wood, solar, geothermal, and wind) are excluded from the total, but in 1978 wood consumed by residential and commercial sector accounted for approximately 0.5 quadrillion Btu.

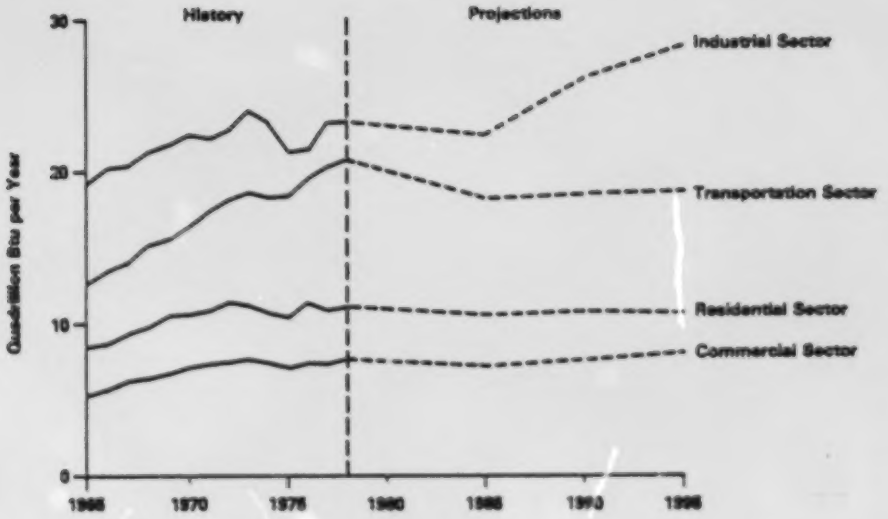
Source: Energy Information Administration, 1980 Annual Report to Congress, Volume Three: Forecasts, U.S. Department of Energy, Government Printing Office, p. 62.

The commercial sector has the lowest net energy consumption of the four sectors examined by EIA and is predicted to remain so (see Table 4). The effects of higher prices and renewable resource programs on the commercial sector's projected consumption increase over time. However, the effects of conservation on consumption remain constant between 1990 and 1995 because, during this period, "retrofitting existing commercial structures is attributed to price effects, rather than to conservation programs that caused commercial retrofits in 1985 and 1990" (see Table 5)[1/]

This forecast for the commercial sector is only to give a brief idea of what may be ahead in the midterm. The future is characterized by uncertainty and chance, however, any energy model forecast must be used carefully. Nonetheless, forecasts are useful for organizing an information base and guiding decision and policy making.

1/ Energy Information Administration, 1980 Annual Report to Congress, Volume Three: Forecasts, U.S. Department of Energy. Government Printing Office, p. 58.

Table 4



Net Energy Consumption by Sector, 1965–95, Middle World Oil Price

Source: Energy Information Administration, 1980 Annual Report to Congress, Volume Three: Forecasts, U.S. Department of Energy, Government Printing Office, p. 47.

Table 5

Commercial Sector: Impact of Energy Price Increases and the Energy Conservation and Renewable Resource Programs, Projections for Middle World Oil Price Scenario, 1985–95

(Quadrillion Btu per Year)

Components	1985[a]	1990	1995
Base Level Consumption with 1978 Constant Prices	8.8	9.8	10.7
Impact of 1980 *Annual Report to Congress* Midprice	-1.4	-1.7	-2.1
Impact of Conservation Programs	-0.2	-0.4	-0.4
Impact of Renewable Resource Programs	[b]	-0.1	-0.1
1980 *Annual Report* Midprice Projections	7.1	7.8	8.1

[a]Numbers may not add to totals due to rounding.
[b]Less than -0.1 quadrillion Btu.

Source: Energy Information Administration, 1980 Annual Report to Congress, Volume Three: Forecasts, U.S. Department of Energy, Government Printing Office, p. 61.

Association Advisors

Robert Atwell, Vice President of American Council on Education and former President of Pitzer College

Nancy Axelrod, Association of Governing Boards, Director of Special Projects and responsible for the Deferred Maintenance Project

Cris Crittenden, Director of Energy Task Force, Association of Physical Plant Administrators of Universities and Colleges

Carol Frances, Chief Economist, American Council on Education

Janet Jackley. Staff Associate, Federal Focus-Management Programs, National Association of College and University Business Officers

Jerry Skogley, Business Officer-in-Residence, National Association of College and University Business Officers: Summer 1981

Thomas Stauffer, Director of External Relations at American Council on Education and staff liaison to the energy research task force of the Higher Education-Business Forum

Selected Annotated Bibliography

Boender, Gary E. "How to Get the Money You Need for Conservation Projects." American School and University 53,2 (October 1980) 66-7.

According to this author the best method for getting conservation projects funded is to establish credibility. This article details how to build credibility for energy management programs.

Crowley, Maureen, editor. Energy Sources of Print and Nonprint Materials. New York: Neal-Schuman Publishers, Inc., 1980.

Publication lists almost 800 organizations, industries, government agencies and specialized publications that are sources of information on all aspects of energy.

Edison Electric Institute Oversight Committee. Economic Growth in the Future - II. Washington, D.C.: Edison Electric Institue.

This report is an executive summary in which the economic and energy outlooks for the period 1980-1990 are analyzed. The report also contains recommendations for various policy issues.

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There are several indexes which may be used for identifying energy literature. The Energy Index, Energy Research Abstracts, Energy Abstracts, and the Energy Abstracts for Policy Analsis are particularly helpful for identifying documents, articles, books, papers, journals and studies written under government contract.[1/] Although the literature ranges from general studies to technical reports most of the books and articles written in the field of energy are very specialized. These indexes would probably be most useful for technical personnel.

For college and university administrators who are interested in general energy information and energy management it is best to review the Education Index, or if available, the Educational Resource Information Clearinghouse (ERIC). It would also be wise to scan the general business (e.g., Business Week, Administrative Management), and Reader's Guide to Periodical Literature.

1/ These indexes are updated regularly and one may gain access to these indexes at most large libraries. Librarians are usually familiar with these publications.

These sources of information may also be purchased directly from the publishers:

Energy Index (yearly) Environment Information Center, Inc., 124 E. 39th Street, New York, NY 10016.

Energy Abstracts (monthly) Ei Information Services Engineering Index, Inc., 345 East 47th Street, New York, N.Y. 10016

Energy Abstracts for Policy Analysis and Energy Research Abstracts (semi-monthly). Available on an exchange basis to colleges and universities. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Both of these publications are published by the U.S. Department of Energy, Technical Information Center, P.O. Box 62, Oak Ridge, Tennessee 37830.

Alternative Energy Developments
Rhine Publishing Co. P.O. Box 3214
Thousdand Oaks, Ca. 91359

The focus of this monthly publication is research and development of alternative energy sources. $35 yr.

Annual Review of Energy
Annual Reviews Inc.
419 El Camino Way, Palo Alto, Ca. 94306

General interest journal the social economic and environmental views of enrgy policy are examined. Annually; $17 yr.

Capital Energy Letter
Capital Energy Letter Inc.
National Pres Bldg. Rm 1272
Washington, D.C. 20045

Reports on the developing energy policy in Washington and also the activiites of energy agencies. Weekly; $355 yr.

Critical Mass
Critical Mass Energy Project, P.O. Box 1538
Washington, D.C. 20013

Discusses various aspects of energy; monthly; $7.50 yr.- individual; $37.50 yr. - business.

EEI Energy News Highlights

All facets of energy and public utility are covered; weekly: free.

Energy Conservation Digest
1098 National Press Building

Focus is energy conservation and buildings; $95 yr.

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Fairchild Publications, 665 National Press Building
Washington, D.C. 20045

Features energy consultant directory annually; Discusses energy policy pertaining to commercial and industrial users of energy; weekly; $30 yr.

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World Future Society
4916 St Elmo Avenue
Washington, D.C. 20014

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National Journal
Government Research Corp.
1730 M St. N.W.
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Reports on recent federal actions pertaining to environment and energy; monthly; $27.50 yr.

Saving Energy
P.O. Box 75837
Los Angeles, Ca. 90075

Presents case histories aimed at industry and business; features one saving energy tip; monthly; $60 yr, $90/2 yrs.

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300 National Press Bldg.
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Newsletter that covers energy research, business and politics; focus in on legislation; $525 yr.